

# **The Efficacy of Dexedrine for the Sustainment of Aviator Performance during 64 hours of Continuous Wakefulness**

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# Introduction

- **Military personnel often are required to perform their duties 24 hours per day during combat.**
- **Sustained and continuous operations create a substantial tactical advantage on the battlefield.**
- **Enemy forces responding around the clock eventually succumb to fatigue from severe sleep deprivation.**
- **Unfortunately, friendly forces may suffer the same fate when insufficient personnel are available.**
- **Thus, fatigue countermeasures are necessary.**

# **Background**

- **Existing countermeasures consist of administrative and pharmacological strategies.**
- **Administrative approaches are palatable, but often not feasible.**
- **Pharmacological approaches appear better for the unpredictable combat environment.**
- **However, few controlled studies of the efficacy of stimulants in aviators exist.**
- **Also, those that do exist have not examined efficacy for sleep loss beyond 40 hours.**

# Objective

- **The current investigation evaluated the efficacy of dextroamphetamine for maintaining aviator alertness and performance despite significant sleep loss.**

# Methods

- **Six UH-60 helicopter pilots (5 males and 1 female) were tested.**
- **Each aviator was exposed to 2 deprivation periods.**
- **In one, 6 doses of Dexedrine (10-mg each) were administered, and in the other placebo was given.**
- **Testing consisted of:**
  - **Instrument flight maneuvers in a UH-60 simulator**
  - **Electroencephalographic examinations**
  - **Mood questionnaires (POMS and VAS)**
  - **Cognitive testing (Multiple Attribute Task Battery)**

# UH-60 Flight Simulator



# Testing Schedule

NOTE: DEX = DEXEDRINE DOSE (10 MG), PBO = PLACEBO

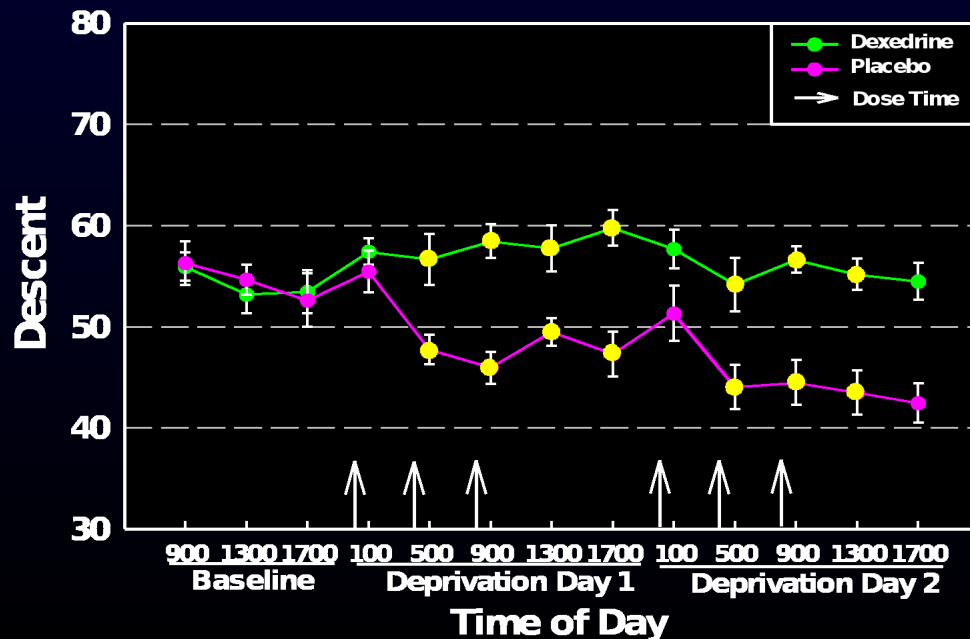
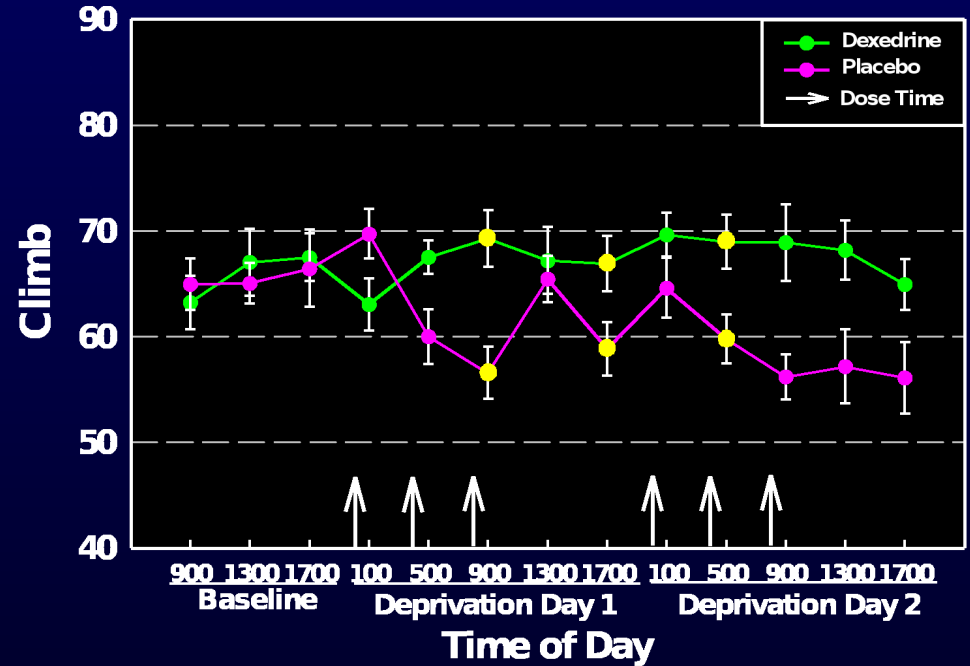
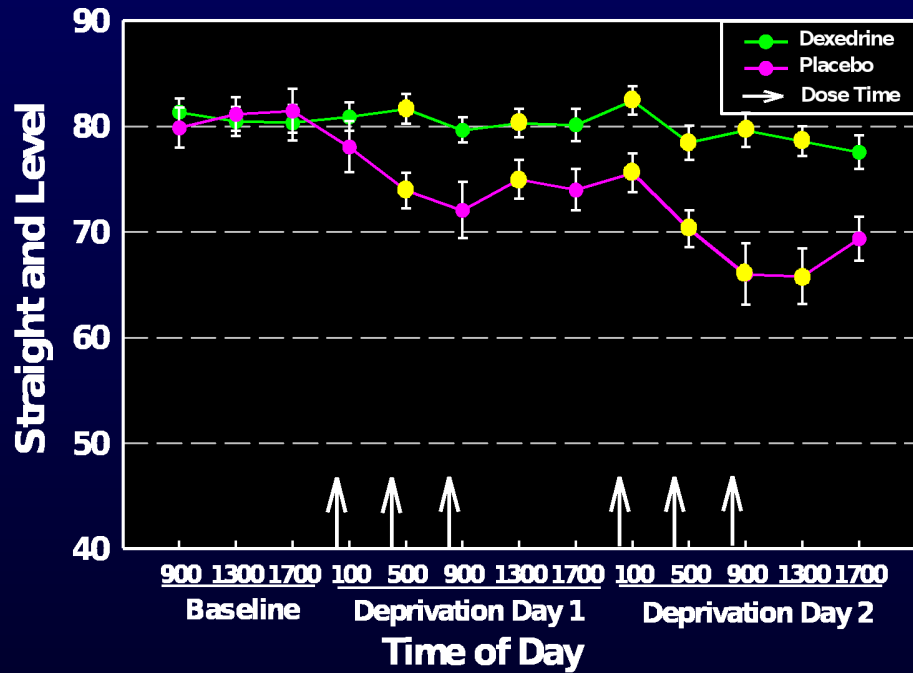
# Results (1)

- **Dexedrine versus Placebo:**
  - sustained flight performance at near baseline levels,
  - attenuated deprivation-related increases in slow-wave EEG activity,
  - sustained higher self-ratings of alertness, energy, talkativeness, and vigor,
  - reduced self-ratings of sleepiness, irritability, fatigue, and confusion,
  - decreased reaction times, time-out errors, and tracking errors.

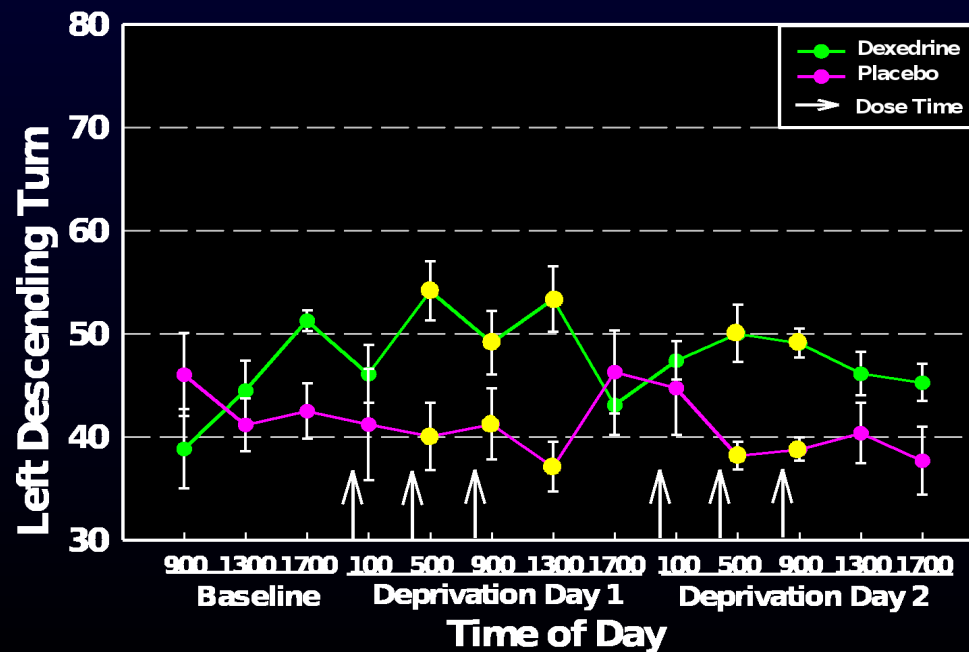
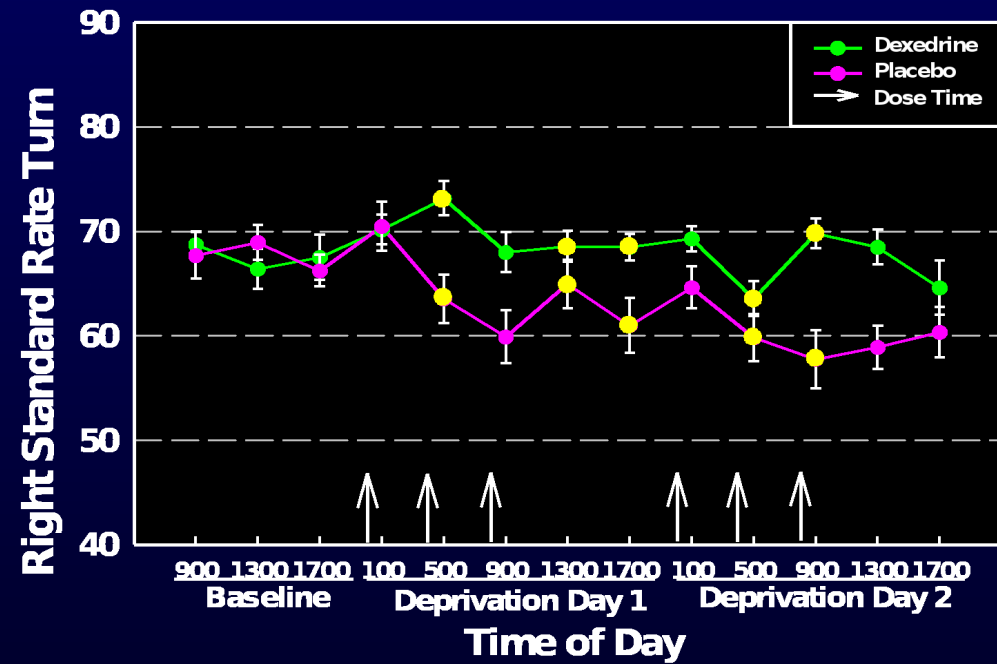
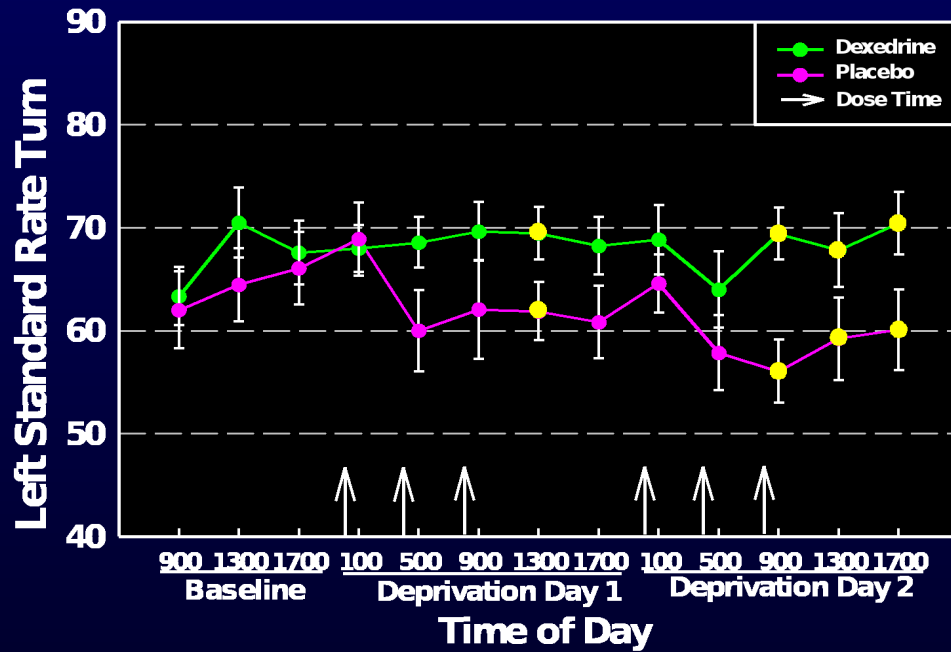
# UH-60 Flight Simulator Cockpit



# Flight Performance Scores (1)



# Flight Performance Scores (2)

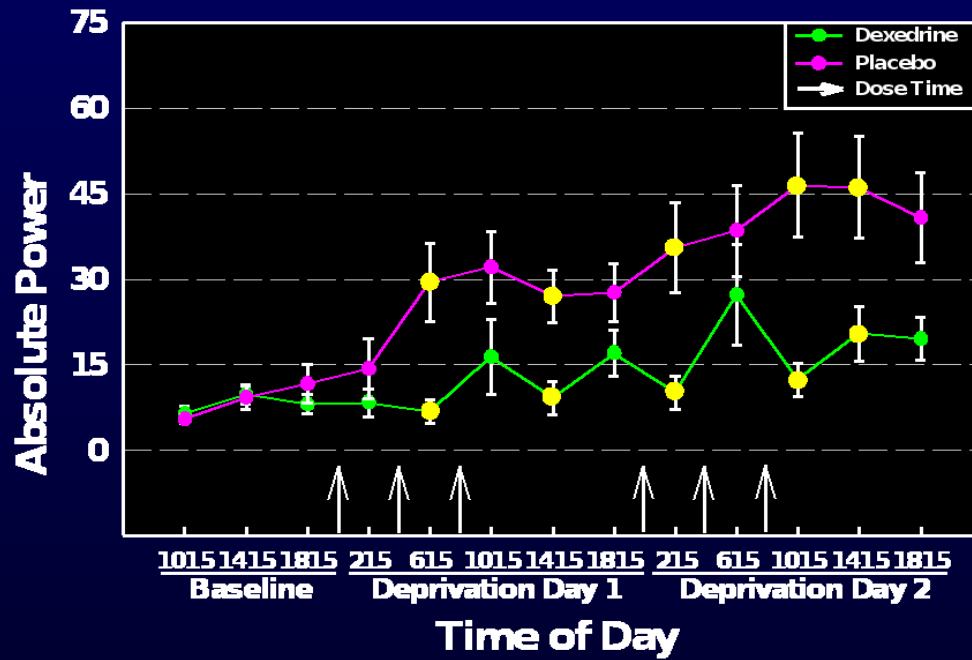


# EEG Data Collection

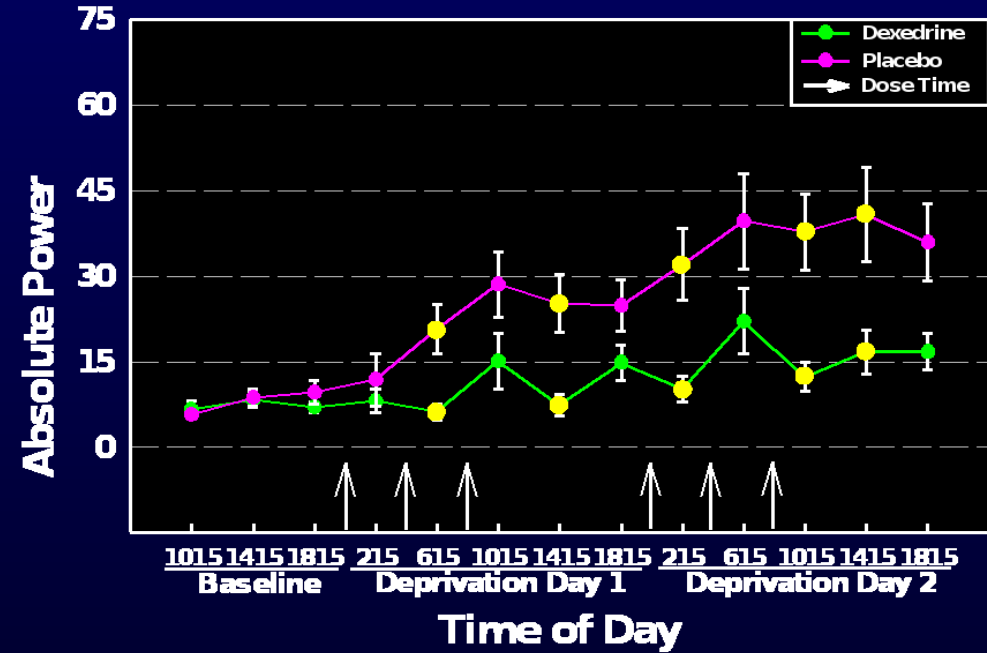


# EEG

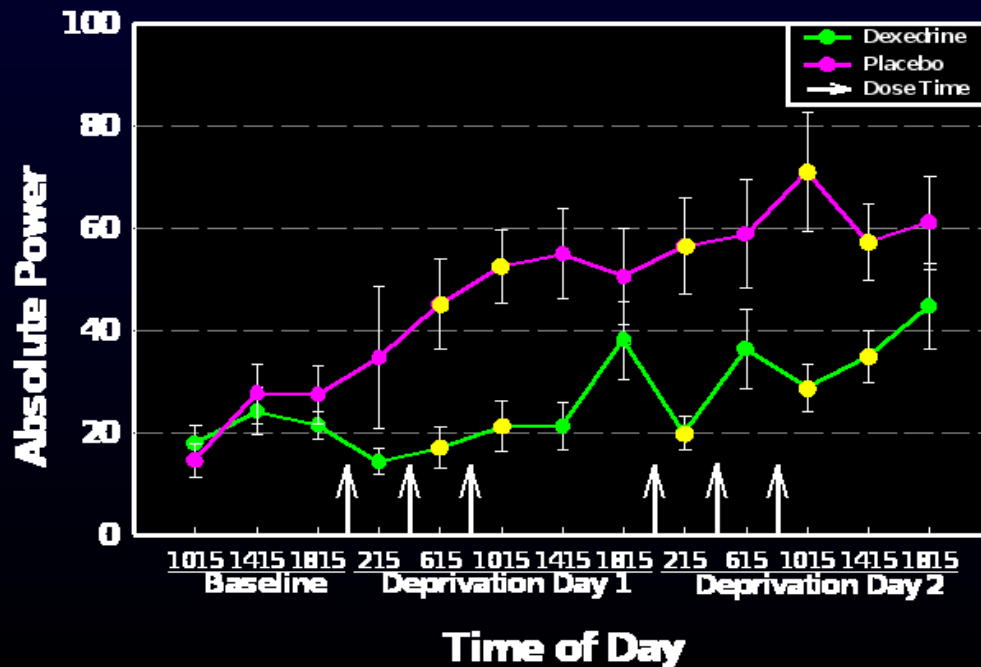
## Delta CZ



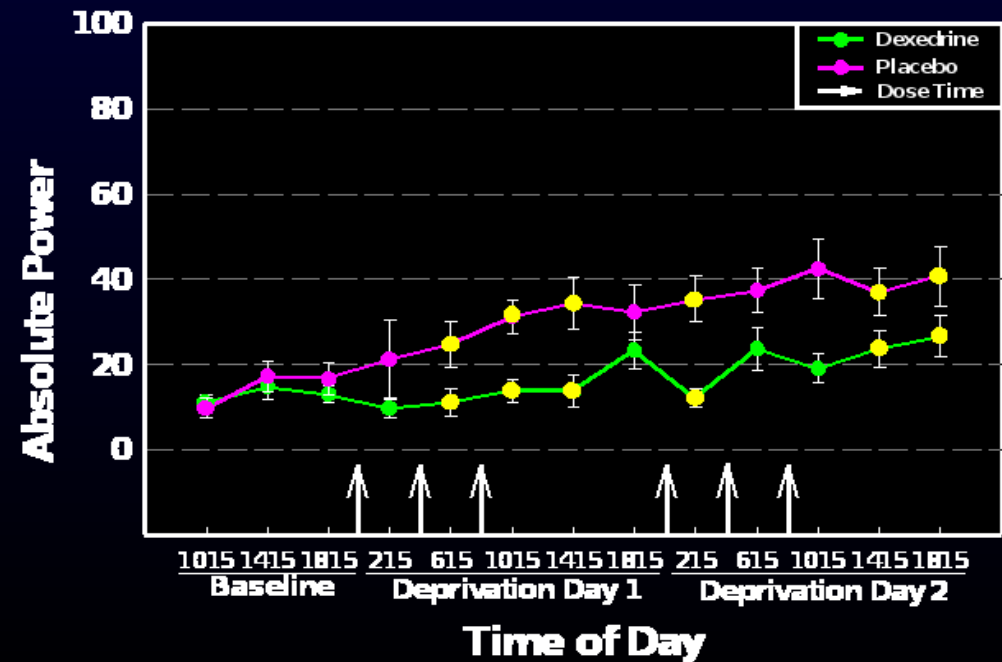
## Delta PZ



## Theta CZ



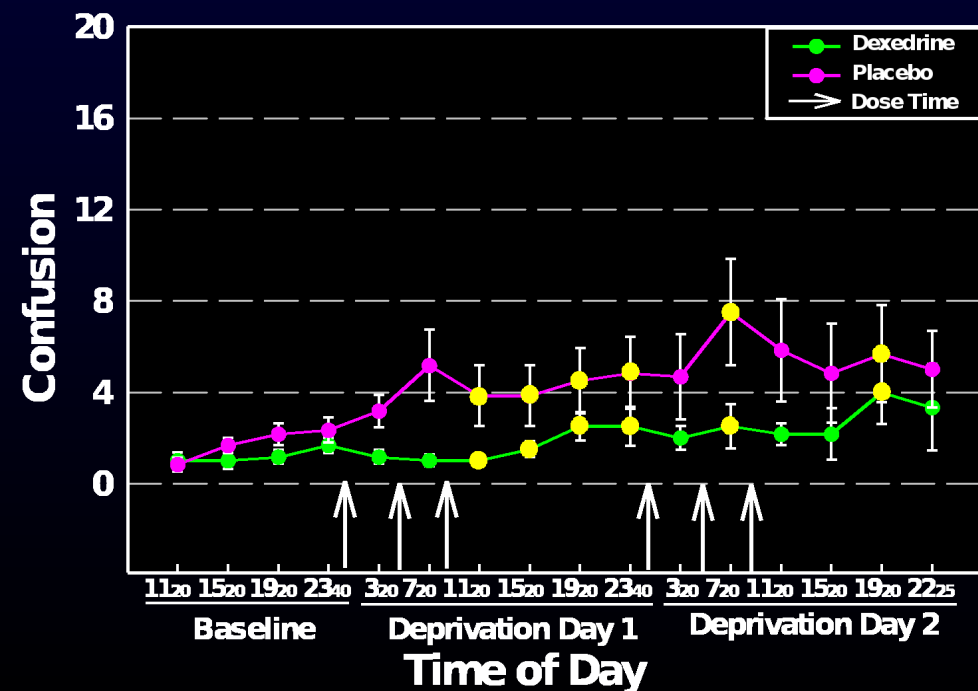
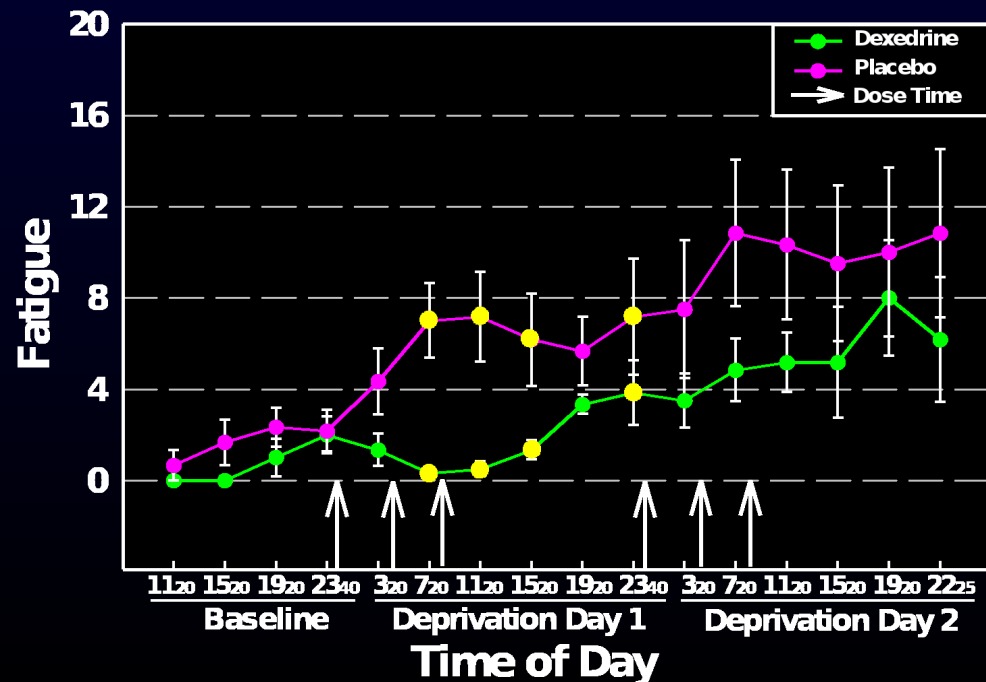
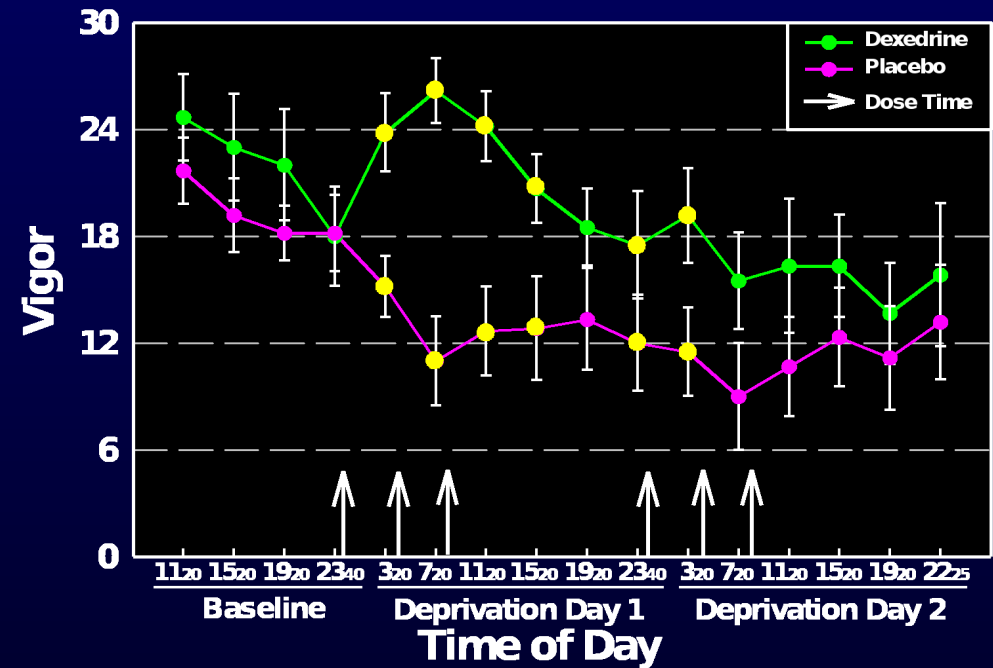
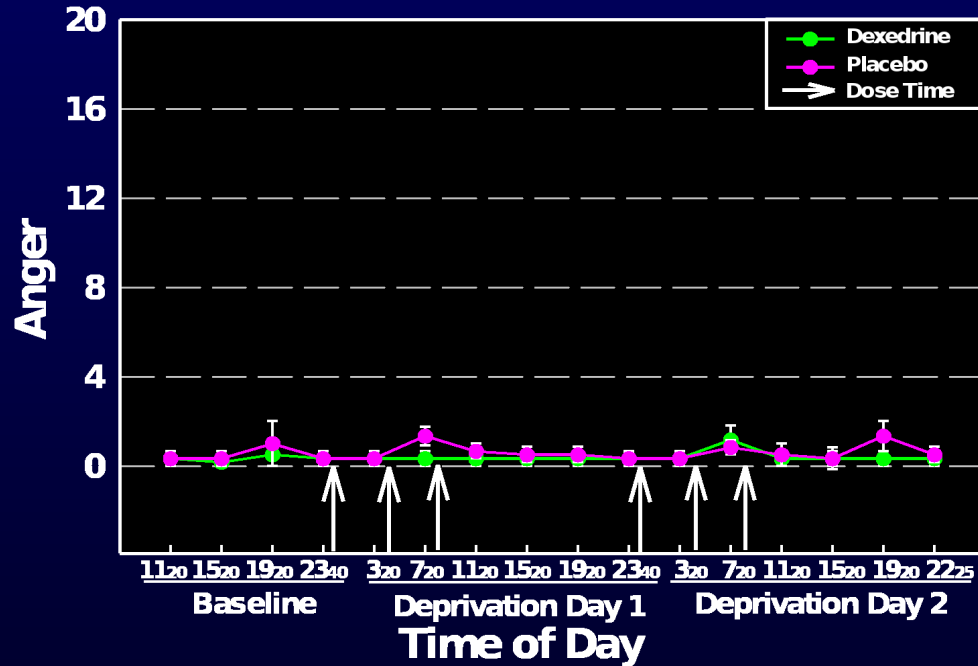
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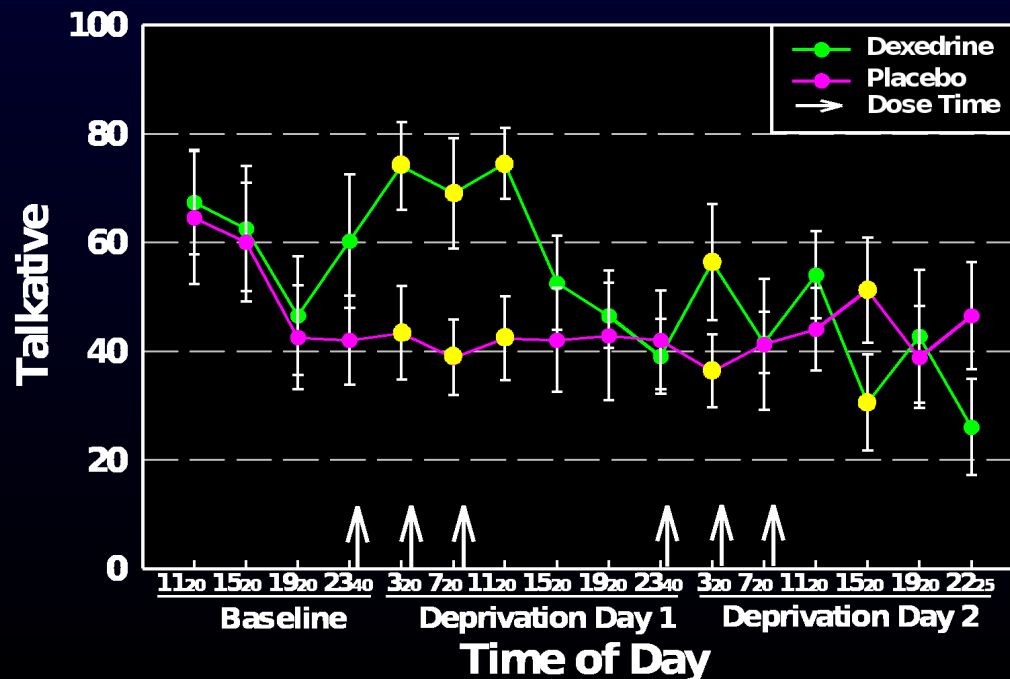
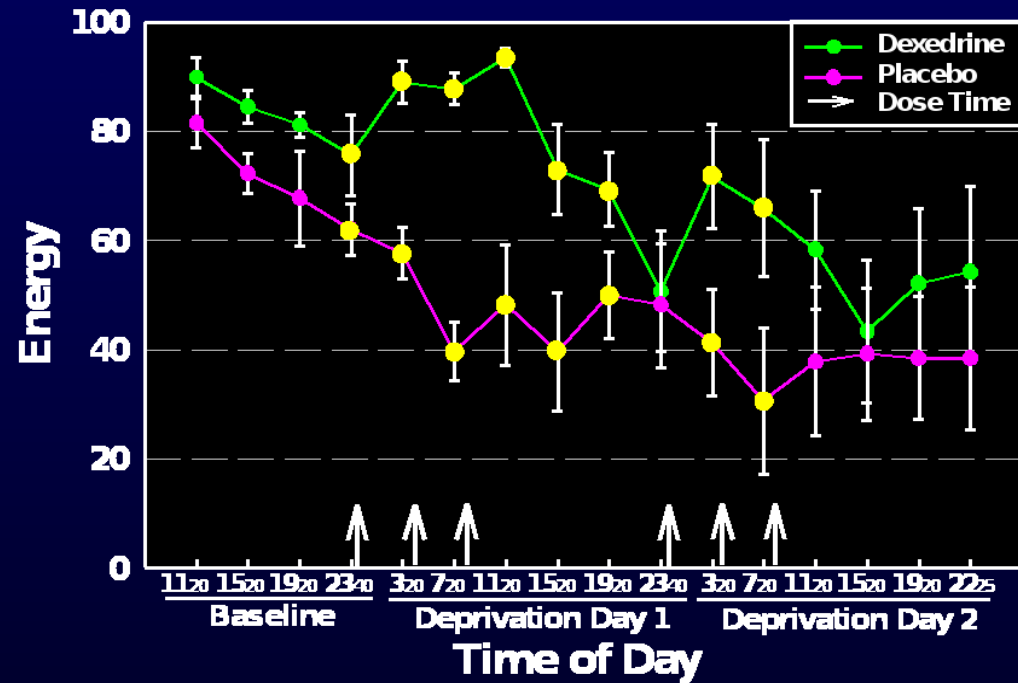
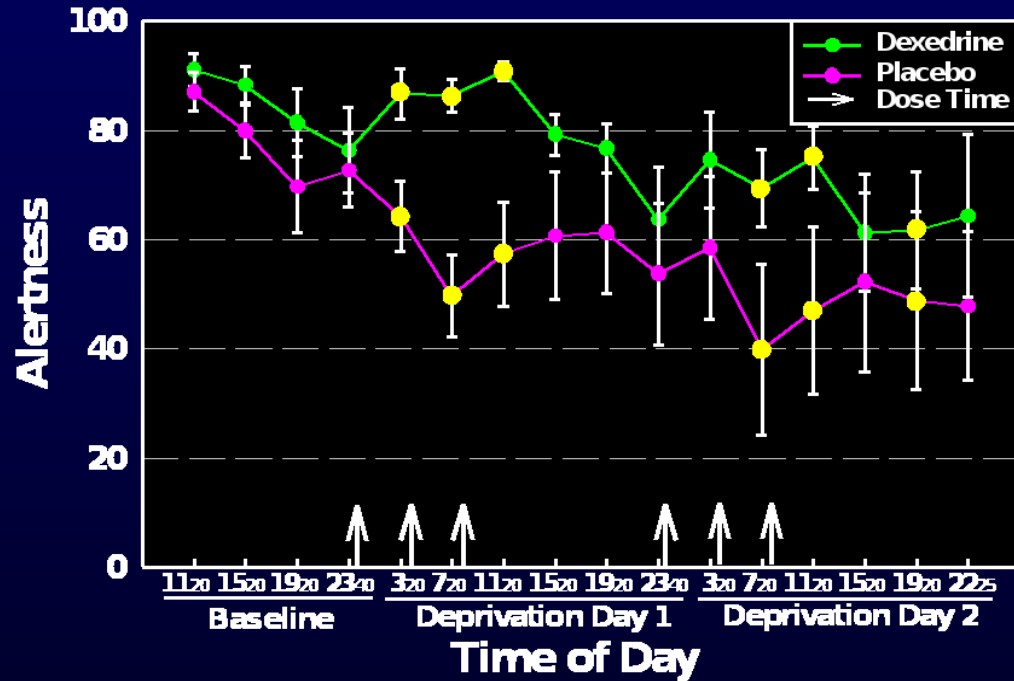
# Profile of Mood States & Visual Analog Scale



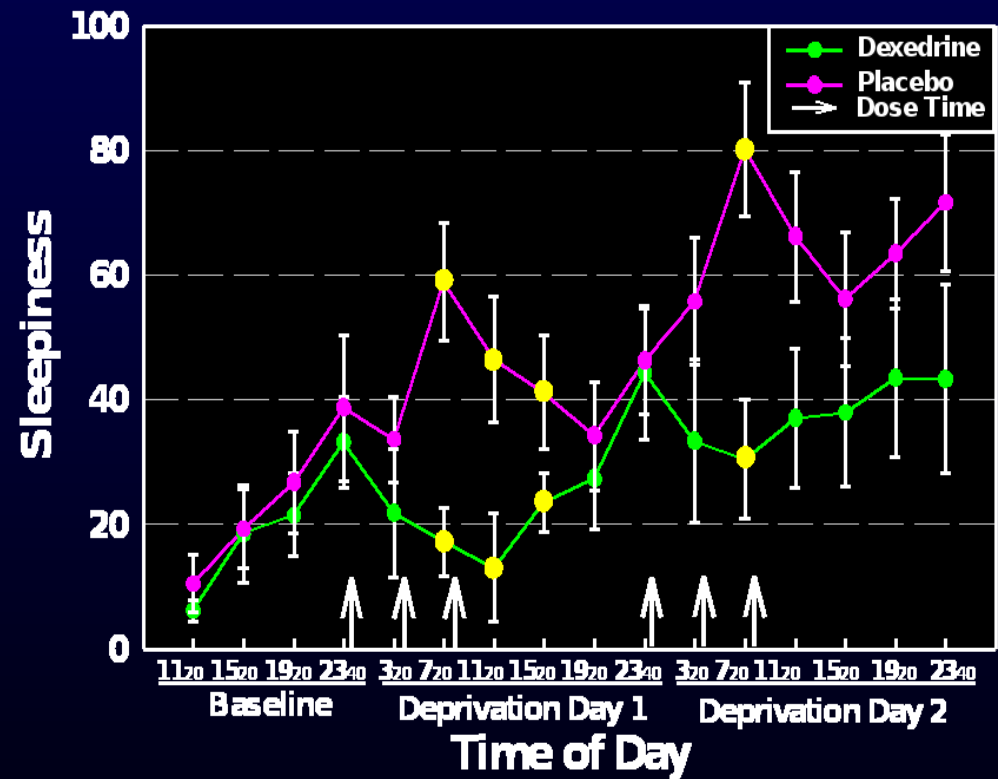
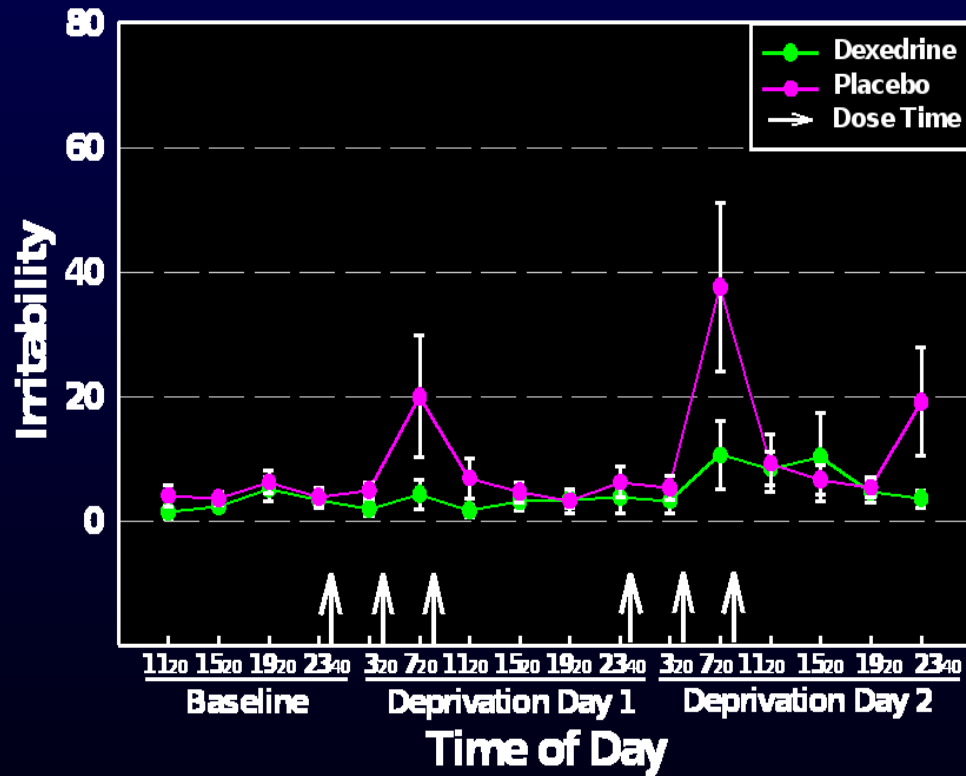
# Profile of Mood States



# Visual Analog Scale (1)



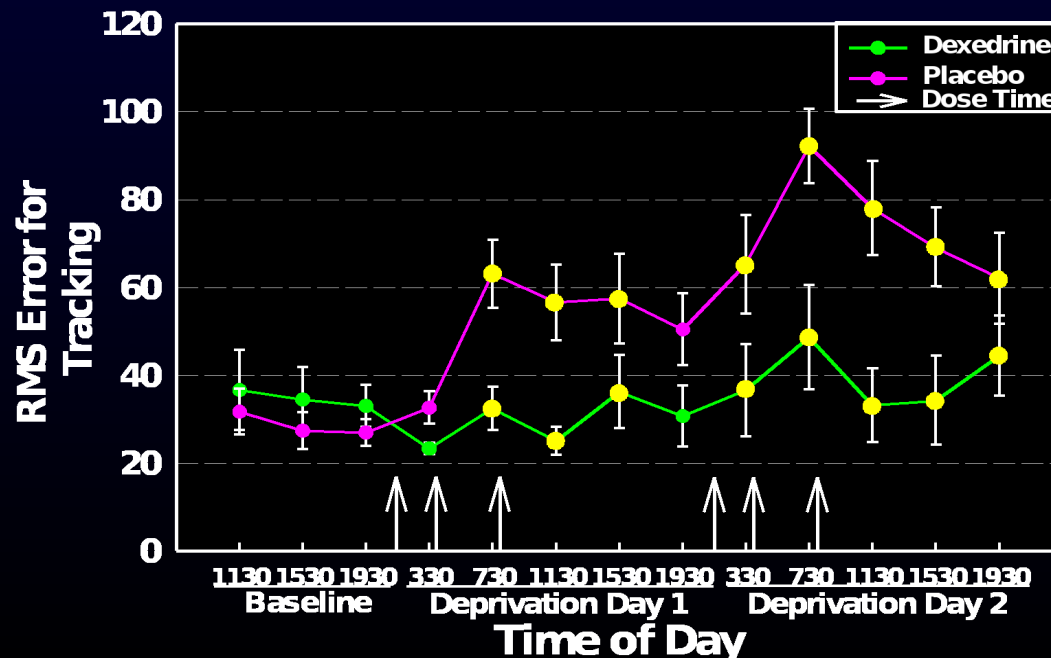
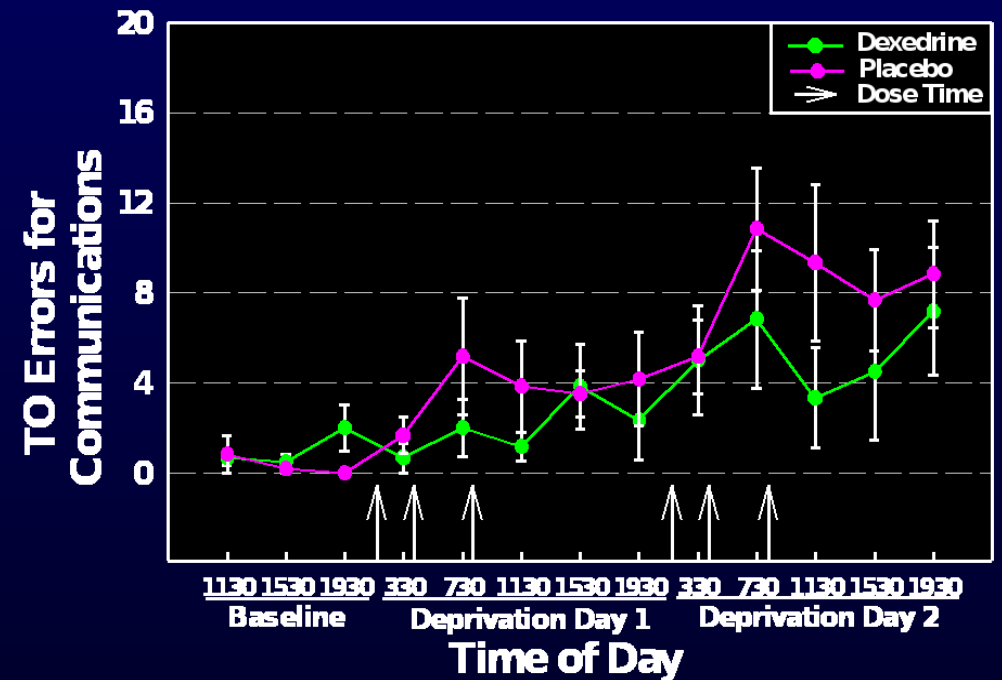
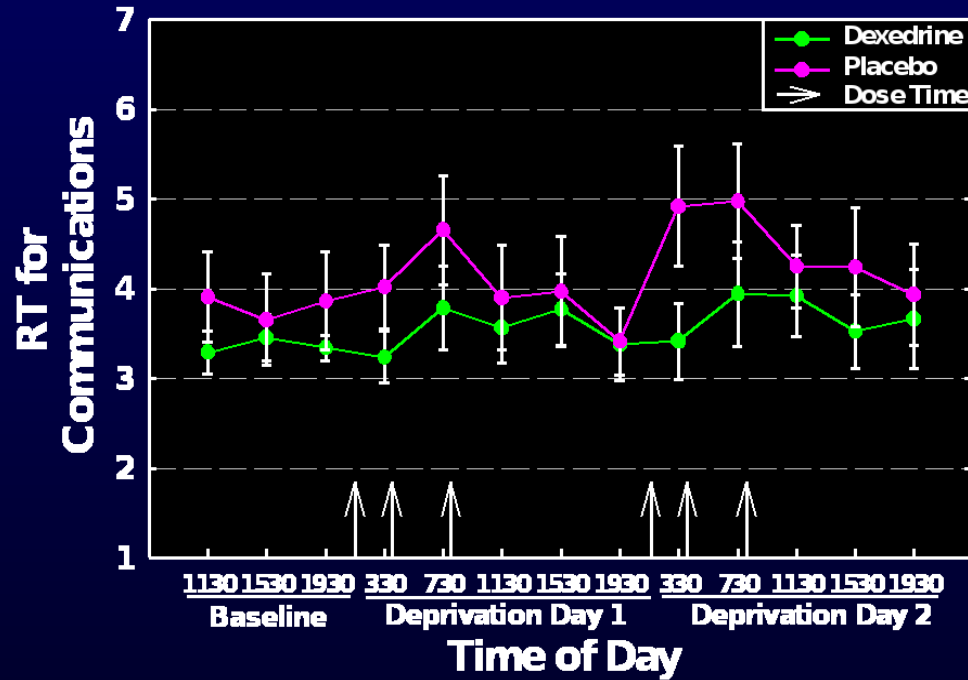
# Visual Analog Scale (2)



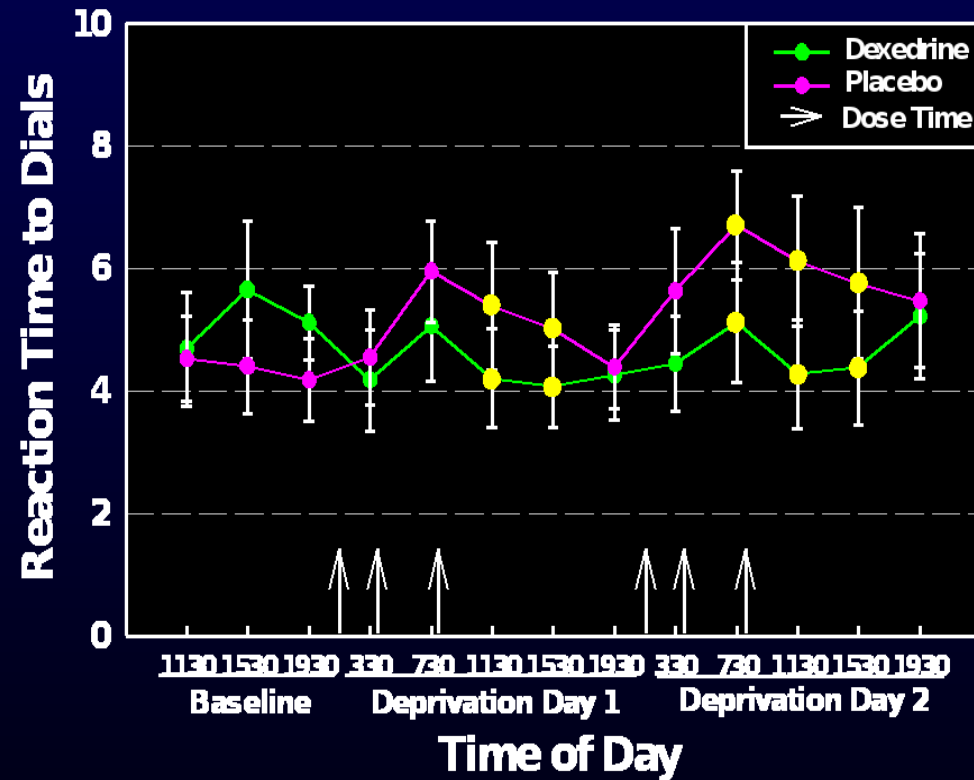
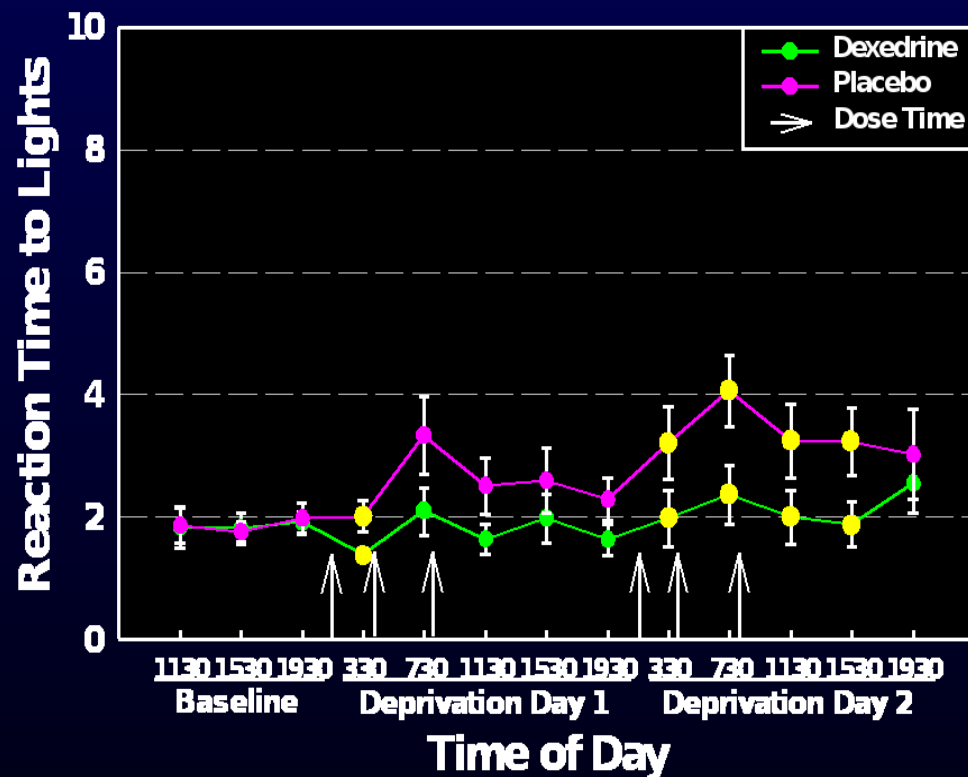
# Multi-Attribute Task Battery



# Multi-Attribute Task Battery (1)



# Multi-Attribute Task Battery (2)



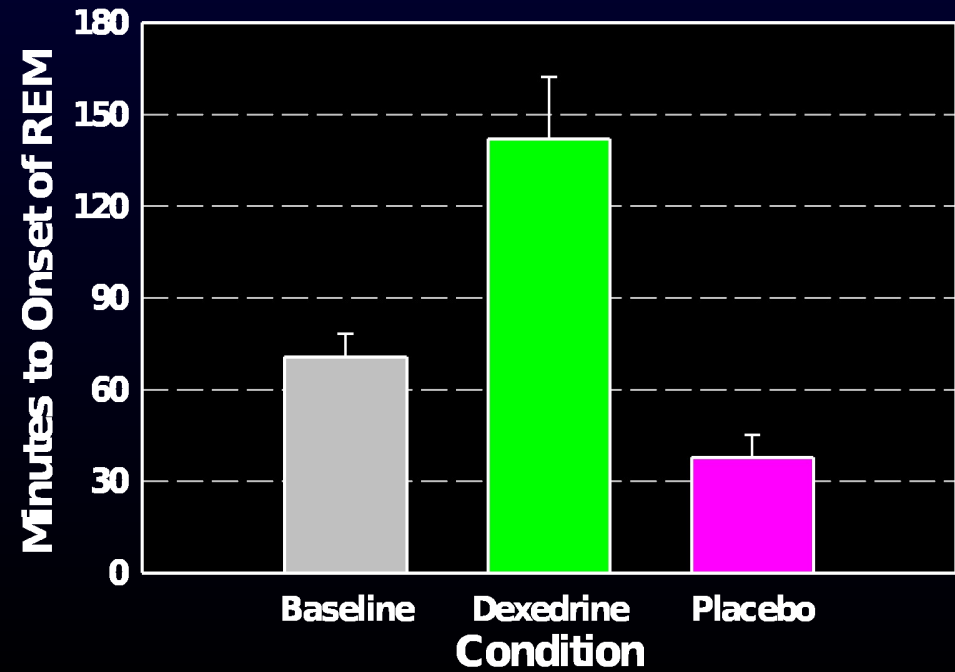
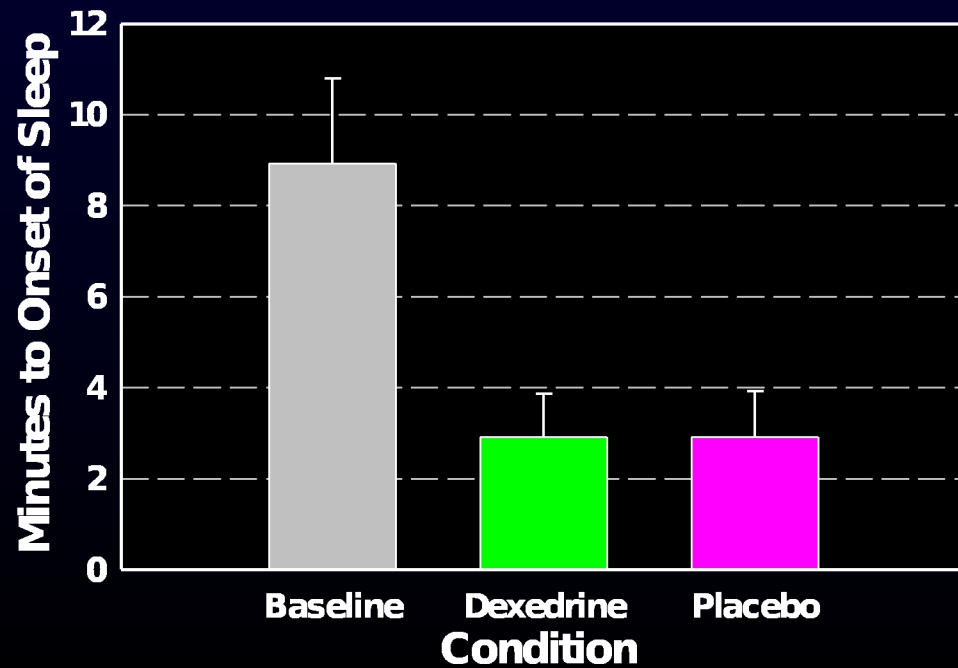
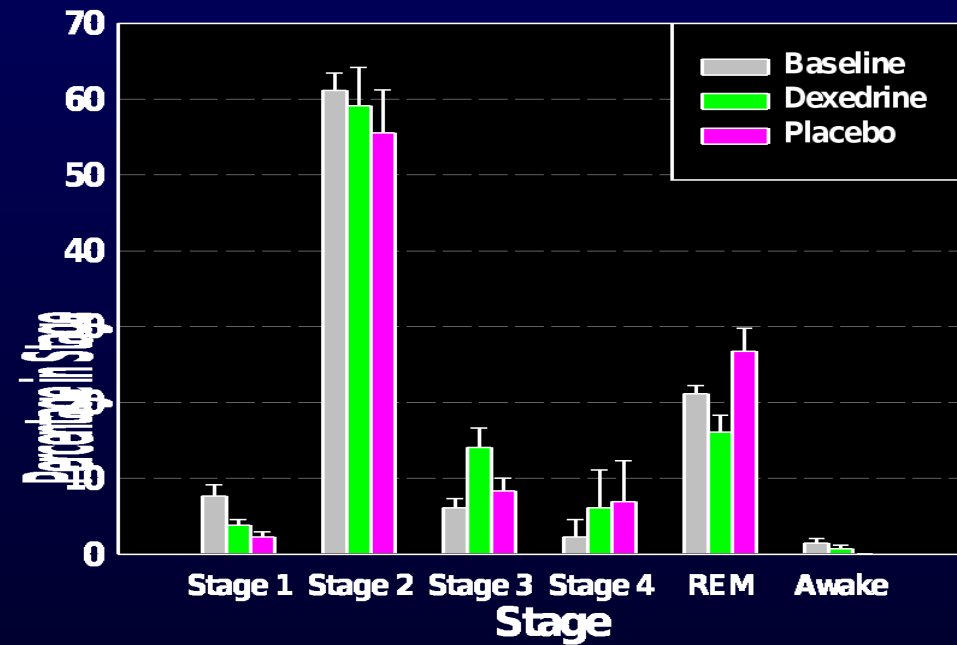
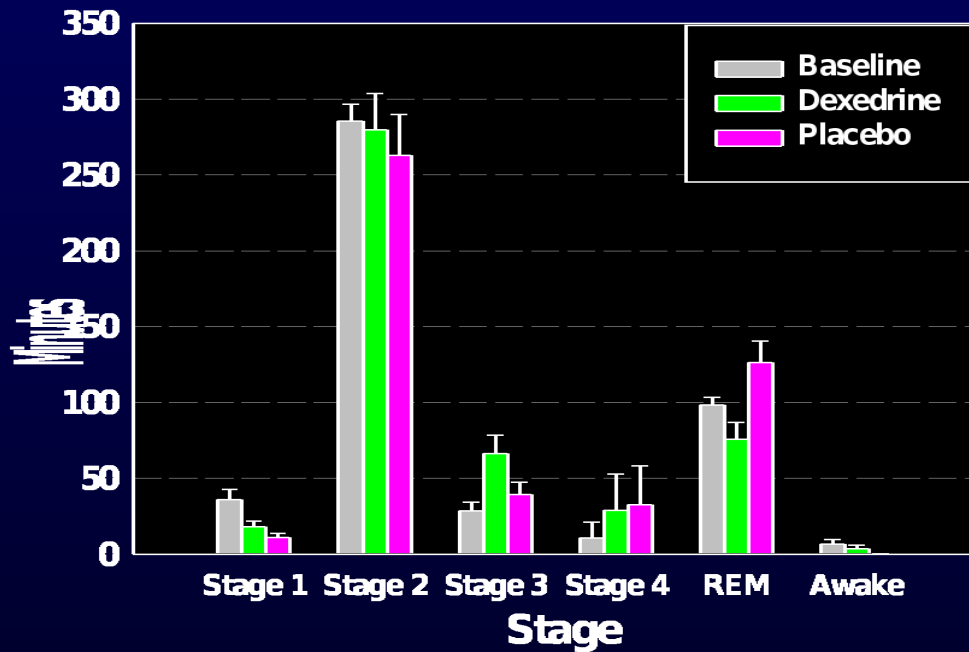
# Results (2)

- **Dexedrine altered recovery sleep even though the last dose was 15 hours before bedtime.**
- **Sleep onset was faster and sleep was deeper after both Dexedrine and placebo compared to baseline, but:**
  - **sleep was less efficient after Dexedrine (versus placebo)**
  - **sleep was lighter (more stage 1) after Dexedrine**
  - **there was less REM sleep and a longer REM latency after Dexedrine**
- **However, there were no spontaneous complaints of sleep problems as a result of Dexedrine.**

# Polysomnographic Data Collection



# Polysomnographic Data



# **Subjective Observations**

- **It was quickly apparent when subjects received Dexedrine vs. placebo (despite double blinding).**
- **Subjects under placebo were:**
  - **withdrawn and sluggish and couldn't keep their eyes open during flights,**
  - **most would have fallen asleep if left to themselves,**
  - **many couldn't remember their flight maneuvers,**
  - **and the majority were extremely irritable.**
- **Dexedrine attenuated or entirely eliminated these problems.**

# Side Effects

- **Subjects became more talkative under Dexedrine--one became talkative to the point of distraction.**
- **One subject manifested diastolic blood pressures of over 100 while on Dexedrine, but these were resolved when retested in the prone position.**
- **Several subjects complained they could feel their hearts beating rapidly.**
- **However, despite these effects, the majority of participants stated they were clearly better off after Dexedrine than placebo.**

# Discussion

- **Flight performance, physiological arousal, and mood were sustained by Dexedrine despite 64 hours of continuous wakefulness.**
- **Giving the drug at midnight, 0400, and 0800 on both deprivation days provided clear benefits without seriously degrading subsequent recovery sleep.**
- **The most positive effects of Dexedrine were apparent from 0300-1200 (the time when fatigue was worst).**
- **Problematic side effects were minimal.**

# Conclusion

- **Dexedrine is a feasible and effective short-term countermeasure for sleep loss in aviation operations.**
- **However, the drug should be given in a controlled fashion only when sleep is not possible.**
- **Dexedrine and other stimulants cannot substitute for adequate sleep!**

